

RAK12004 Quick Start Guide

Prerequisite

What Do You Need?

Before going through each and every step on using RAK12004 WisBlock MQ2 module, make sure to prepare the necessary items listed below:

Hardware

- [RAK12004 WisBlock MQ2 Gas Sensor Module](#)
- Your choice of [WisBlock Base](#) with IO slot
- Your choice of [WisBlock Core](#)
- USB Cable
- [Li-Ion/LiPo battery](#) (required)
- [Solar charger](#) (optional)

Software

- Download and install [Arduino IDE](#) .
- To add the RAKwireless Core boards on your Arduino project, install the RAKwireless Arduino BSP. Follow the steps in the [RAKwireless Arduino BSP](#) .

Product Configuration

Hardware Setup

RAK12004 module is part of the WisBlock Sensor category and extends the WisBlock system with a gas sensor alert system. The RAK12004 connects to the WisBlock Base Board through the IO slot. The **Figure 1** shows the assembly of a [WisBlock Core](#) highlighted in green and the module RAK12004 highlighted in red. Also, always secure the connection of the WisBlock module by using the compatible screws. For more information about RAK12004, refer to the [Datasheet](#).

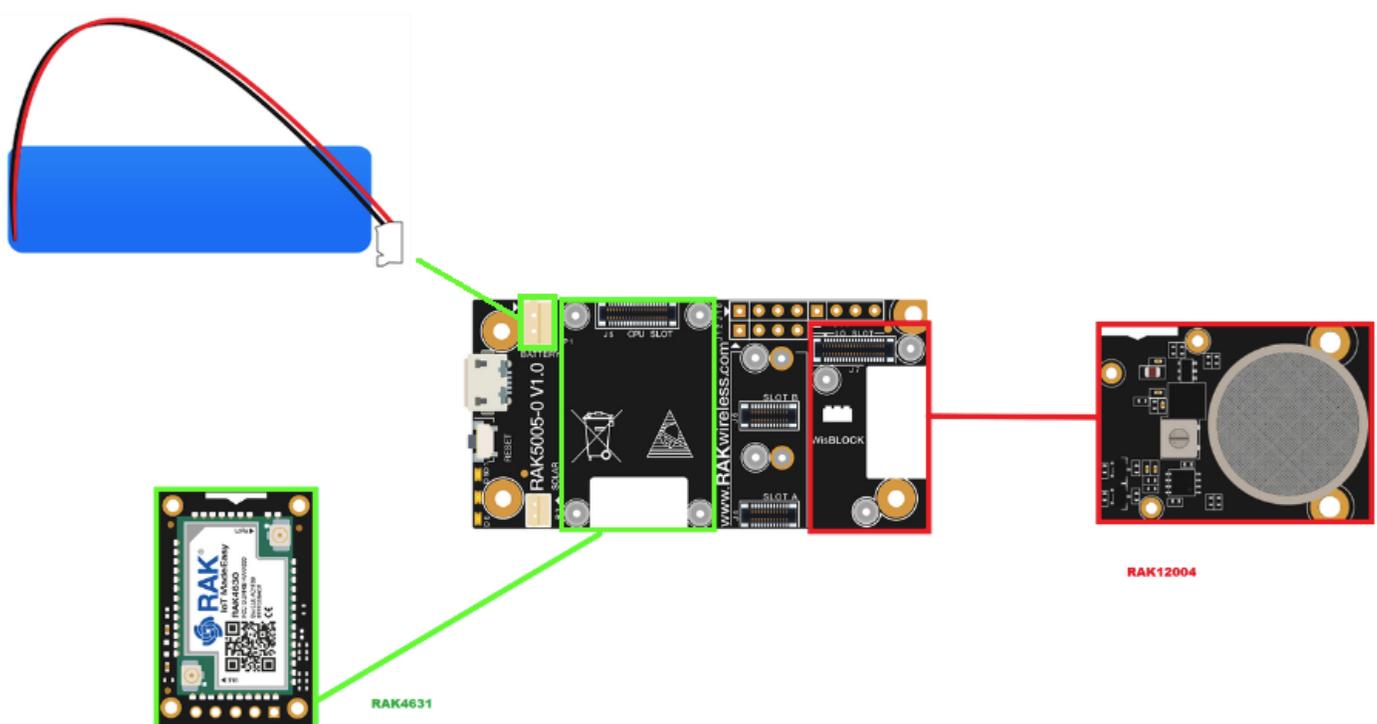


Figure 1: RAK12004 connection to WisBlock Base Board

Assembling and Disassembling of WisBlock Modules

Assembling

As shown in **Figure 2**, the location for the IO slot is properly marked by silkscreen. Follow carefully the procedure defined in [WisBlock Base board assembly/disassembly instructions](#) to attach a WisBlock module. Once attached, carefully fix the module with one or more pieces of M1.2 x 3 mm screws depending on the module.

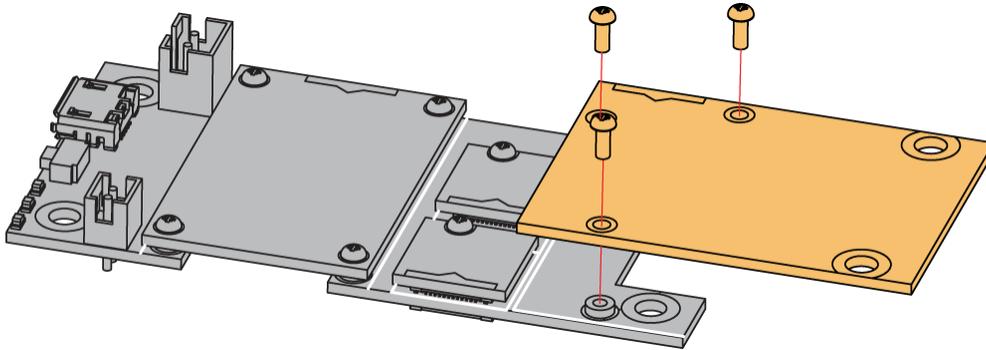


Figure 2: RAK12004 connection to WisBlock Base Board

Disassembling

The procedure in disassembling any type of WisBlock modules is the same.

1. First, remove the screws.

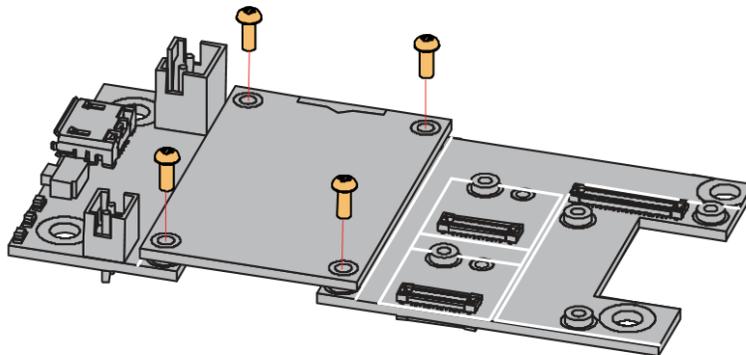


Figure 3: Removing screws from the WisBlock module

2. Once the screws are removed, check the silkscreen of the module to find the correct location where force can be applied.



Figure 4: Detaching silkscreen on the WisBlock module

3. Apply force to the module at the position of the connector, as shown in **Figure 5**, to detach the module from the baseboard.

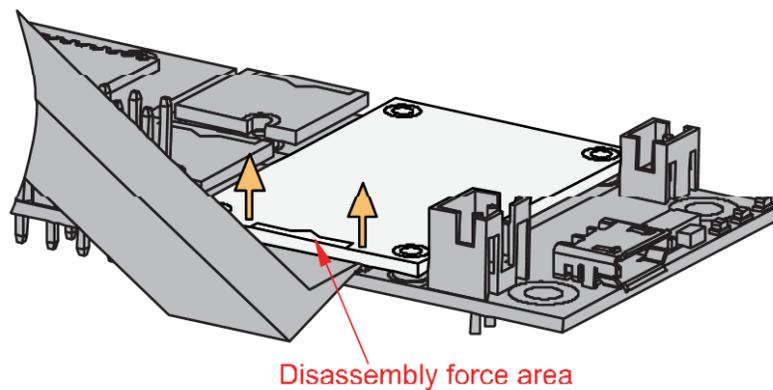


Figure 5: Applying even forces on the proper location of a WisBlock module

NOTE

If you will connect other modules to the remaining WisBlock Base slots, check on the [WisBlock Pin Mapper](#) tool for possible conflicts. RAK12004 uses I2C and IO pins it can cause possible conflict especially on some IO modules.

After all this setup, you can now connect the battery and USB cable to start programming your WisBlock Core.

WARNING

- Batteries can cause harm if not handled properly.
- Only 3.7-4.2 V Rechargeable LiPo batteries are supported. It is highly recommended not to use other types of batteries with the system unless you know what you are doing.
- If a non-rechargeable battery is used, it has to be unplugged first before connecting the USB cable to the USB port of the board to configure the device. Not doing so might damage the battery or cause a fire.
- Only 5 V solar panels are supported. Do not use 12 V solar panels. It will destroy the charging unit and eventually other electronic parts.
- Make sure the battery wires match the polarity on the WisBlock Base board. Not all batteries have the same wiring.

Software Configuration and Example

The RAK12004 has an electronic sensor used for sensing the concentration of gases in the air. It contains a sensing material whose resistance changes when it comes in contact with the gas. Concentrations of gas is measured using a voltage divider network present in the sensor. The output of the sensing element is connected to a 12-bit ADC (ADC121C021) which communicates through I2C to the application.

Initial Test of the RAK12004 WisBlock Module

1. Install the [RAKwireless Arduino BSP](#) for WisBlock by using the `package_rakwireless_index.json` board installation package. The WisBlock Core should now be available on the Arduino IDE.
2. You need to select first the WisBlock Core you have.

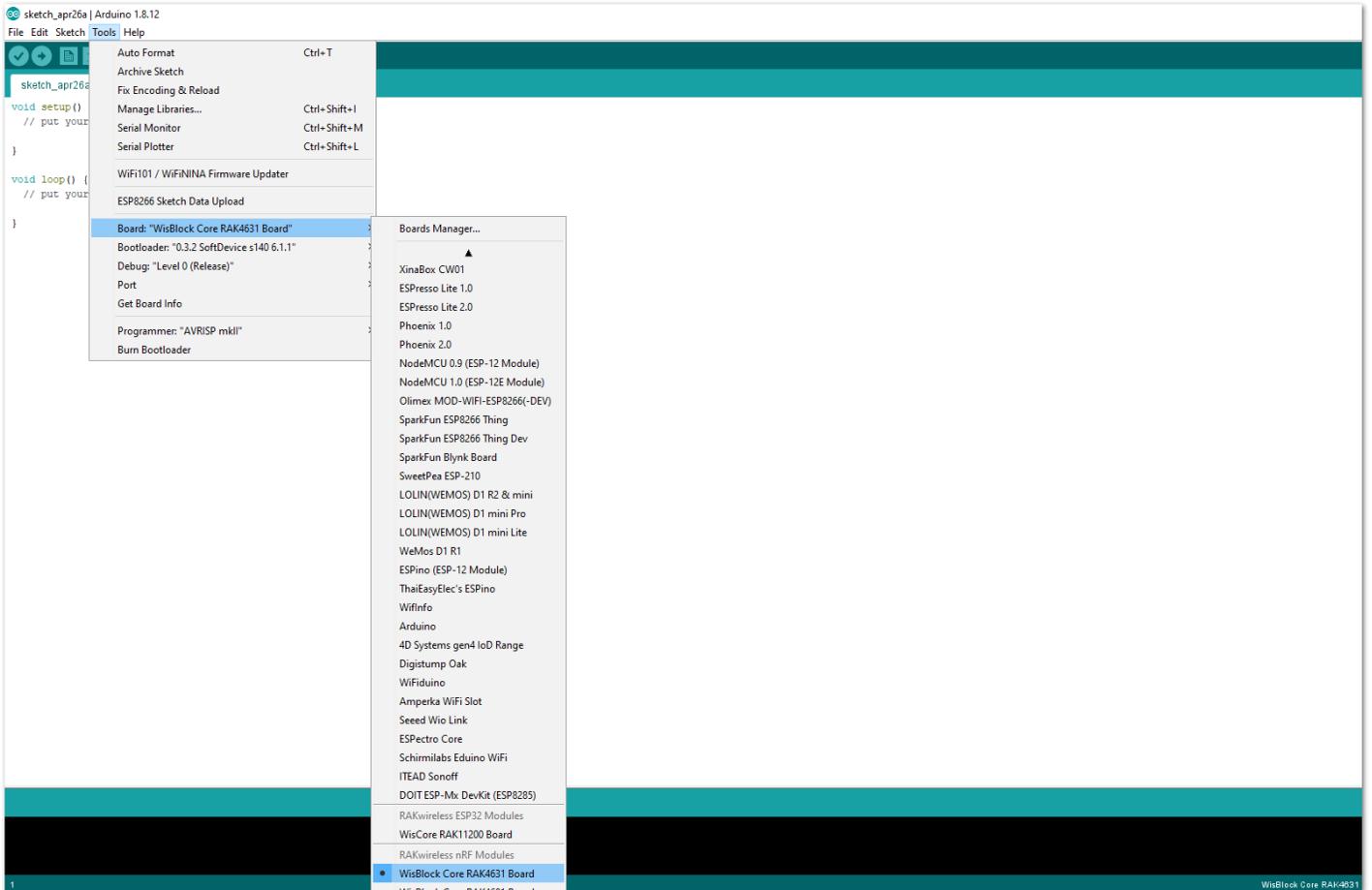


Figure 6: Selecting RAK4631 as WisBlock Core

RAK11200 Board

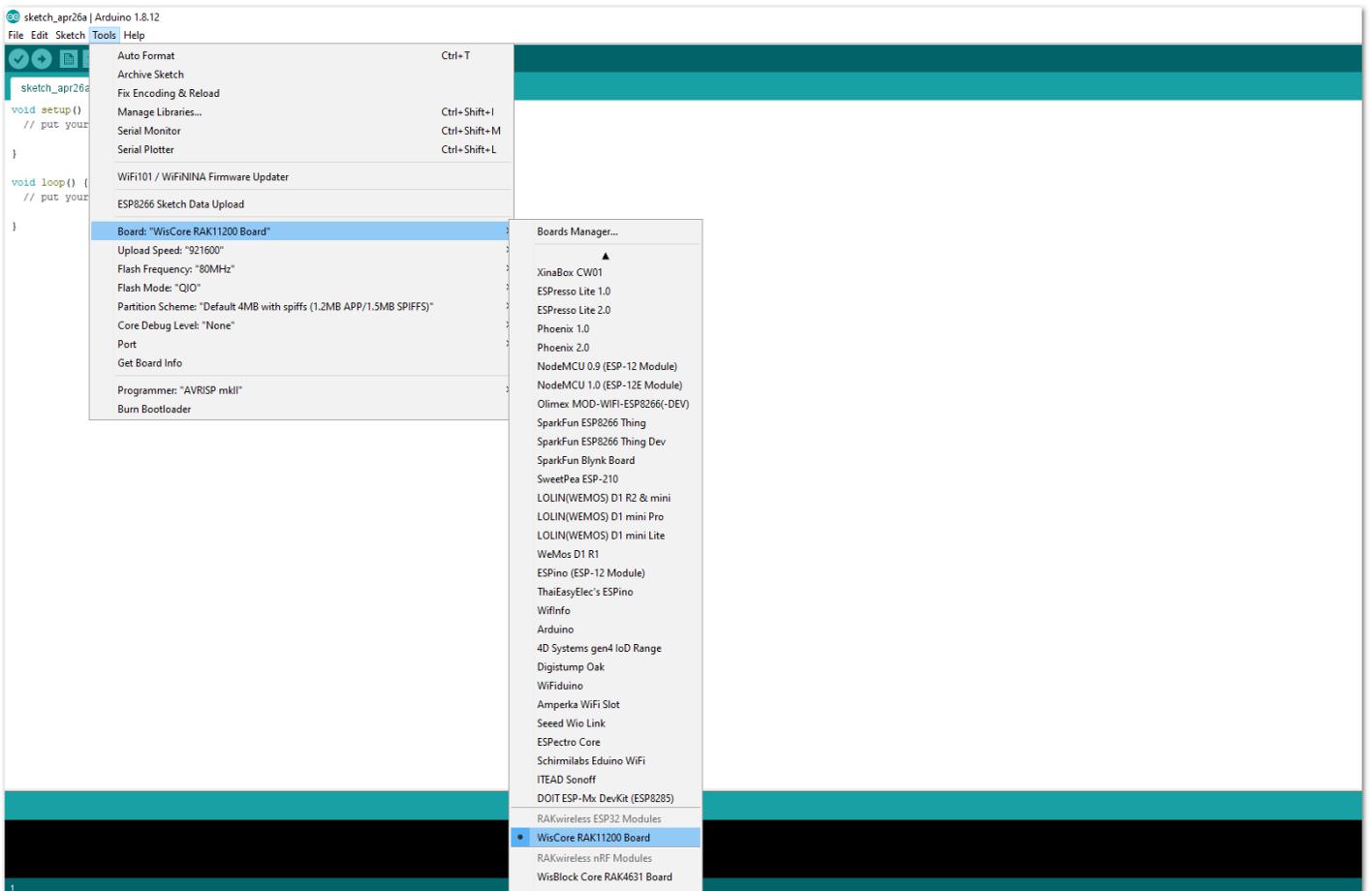


Figure 7: Selecting RAK11200 as WisBlock Core

RAK11310 Board

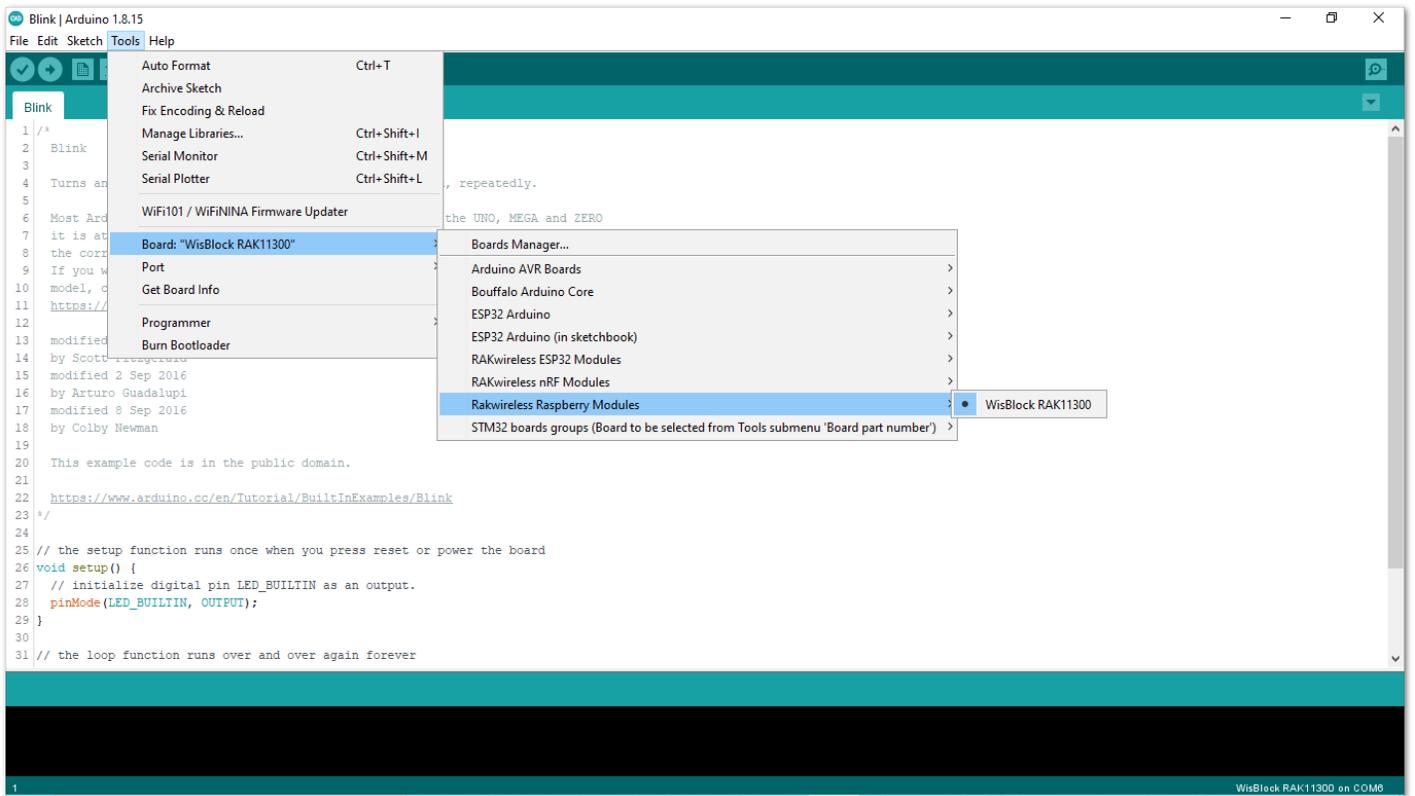


Figure 8: Selecting RAK11310 as WisBlock Core

3. Install the [RAKwireless MQx Library](#) using Arduino Library Manager.
4. On the Arduino IDE, select **Sketch -> Include Library -> Manage Libraries**, as shown in **Figure 9**.
5. On the **Library Manager** text area, type **RAKwireless MQx**.

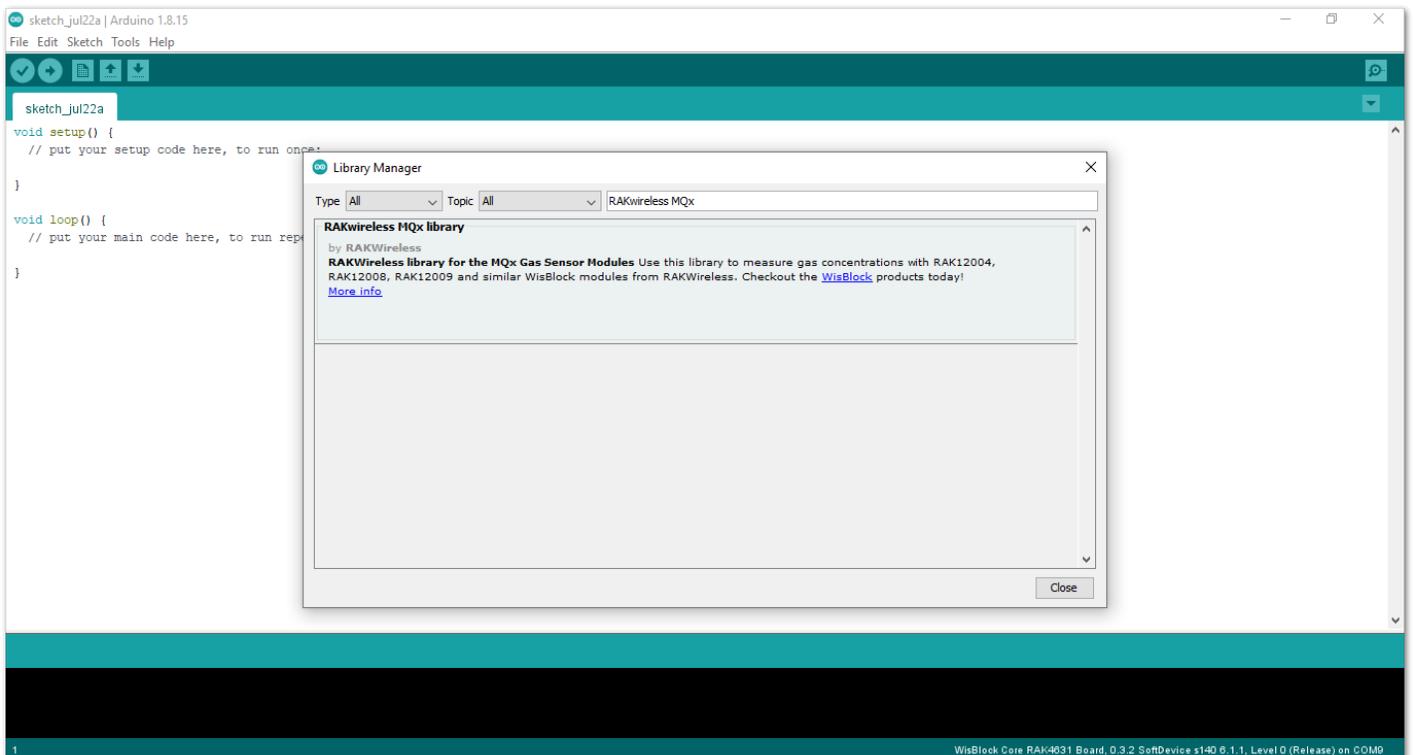


Figure 9: Arduino Library Manager

6. To finish the installation, click on the **Install** button, as shown in **Figure 10**.

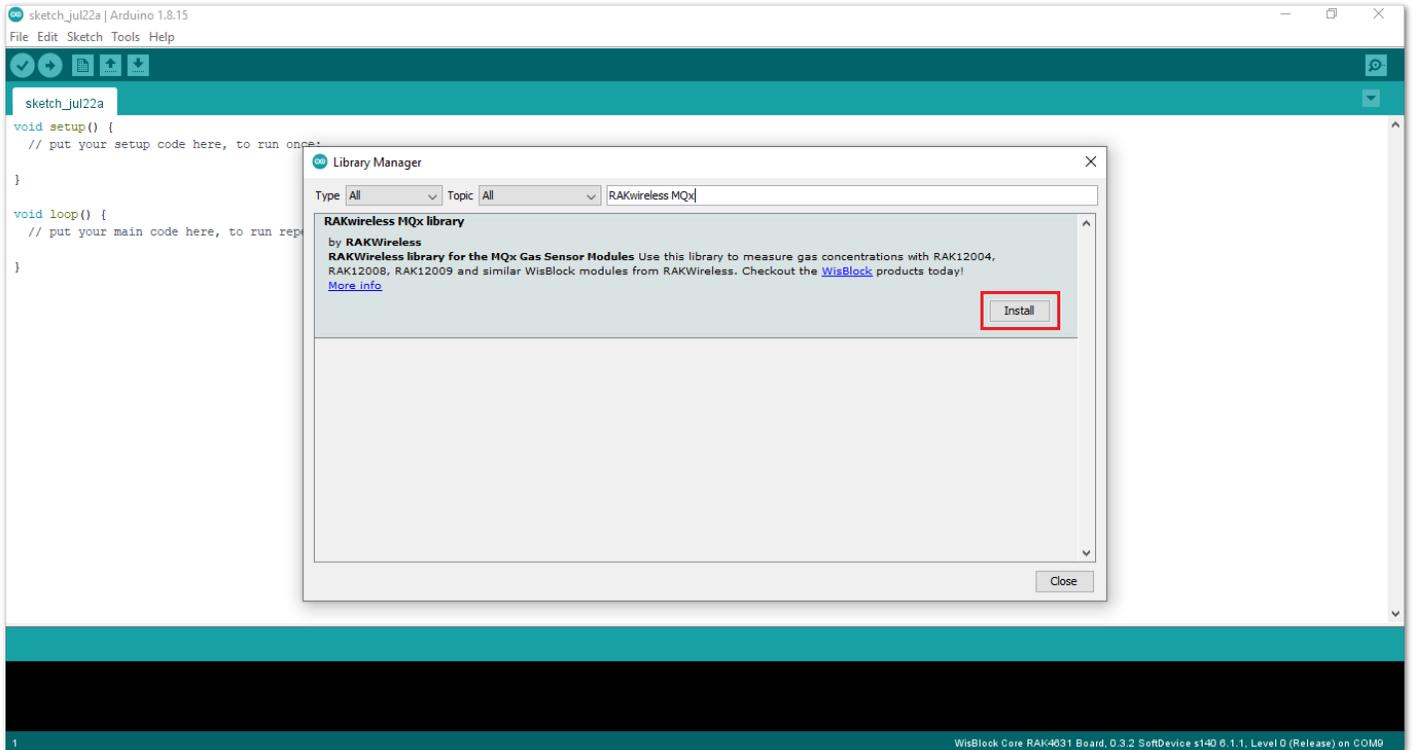


Figure 10: Finish RAK-MQx library Installation

7. Once the library is installed, open the **RAK12004_MQ2_Sampling** example.
8. On the Arduino IDE, select **File -> Examples -> RAKWireless MQx Libraries -> RAK12004_MQ2_Sampling**, as shown in **Figure 11**.

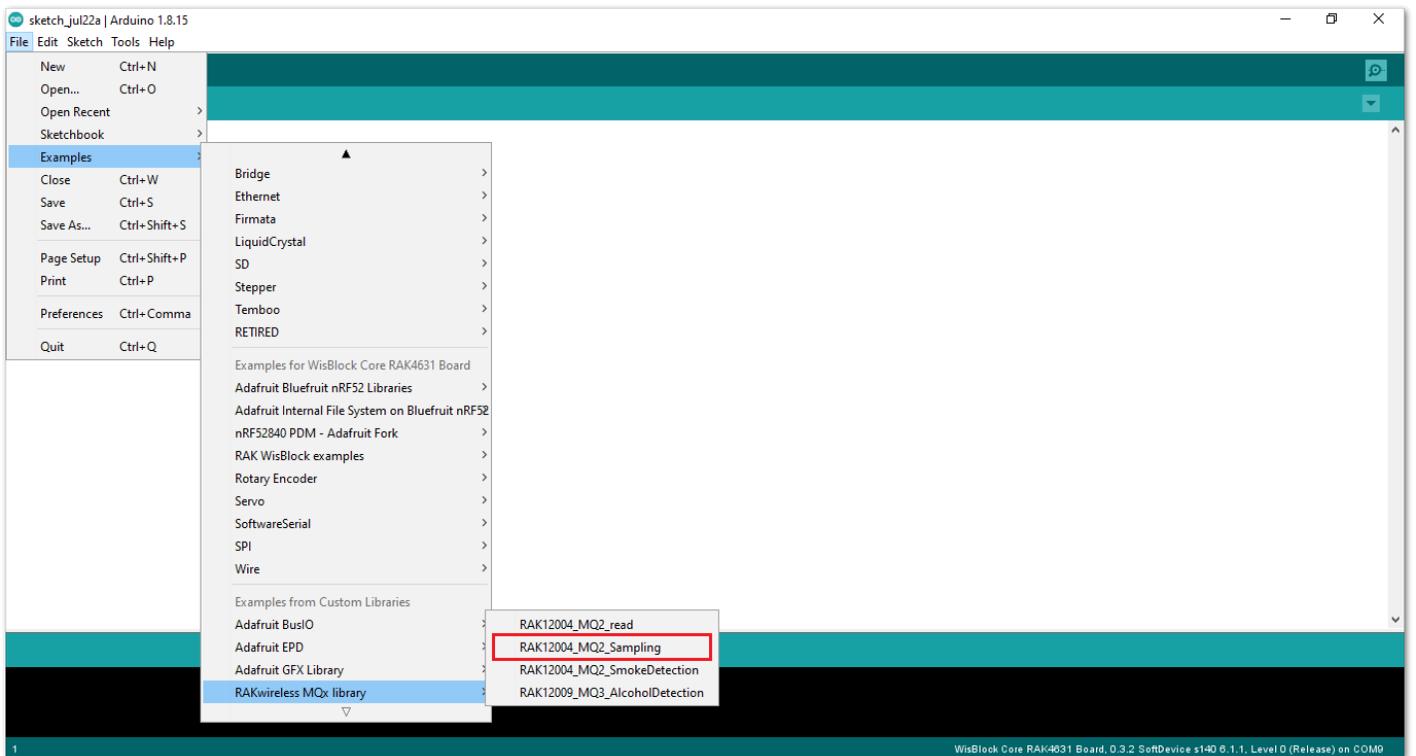


Figure 11: Open RAK12004 MQ2 Sampling Sketch

NOTE

If you experience any error in compiling the example sketch, check the updated code for the RAK12004 WisBlock MQ2 Gas Sensor Module that can be found on the [RAK12004 WisBlock Example Code Repository](#) .

9. You can now select the right serial port and upload the code, as shown in **Figure 12** and **Figure 13**.

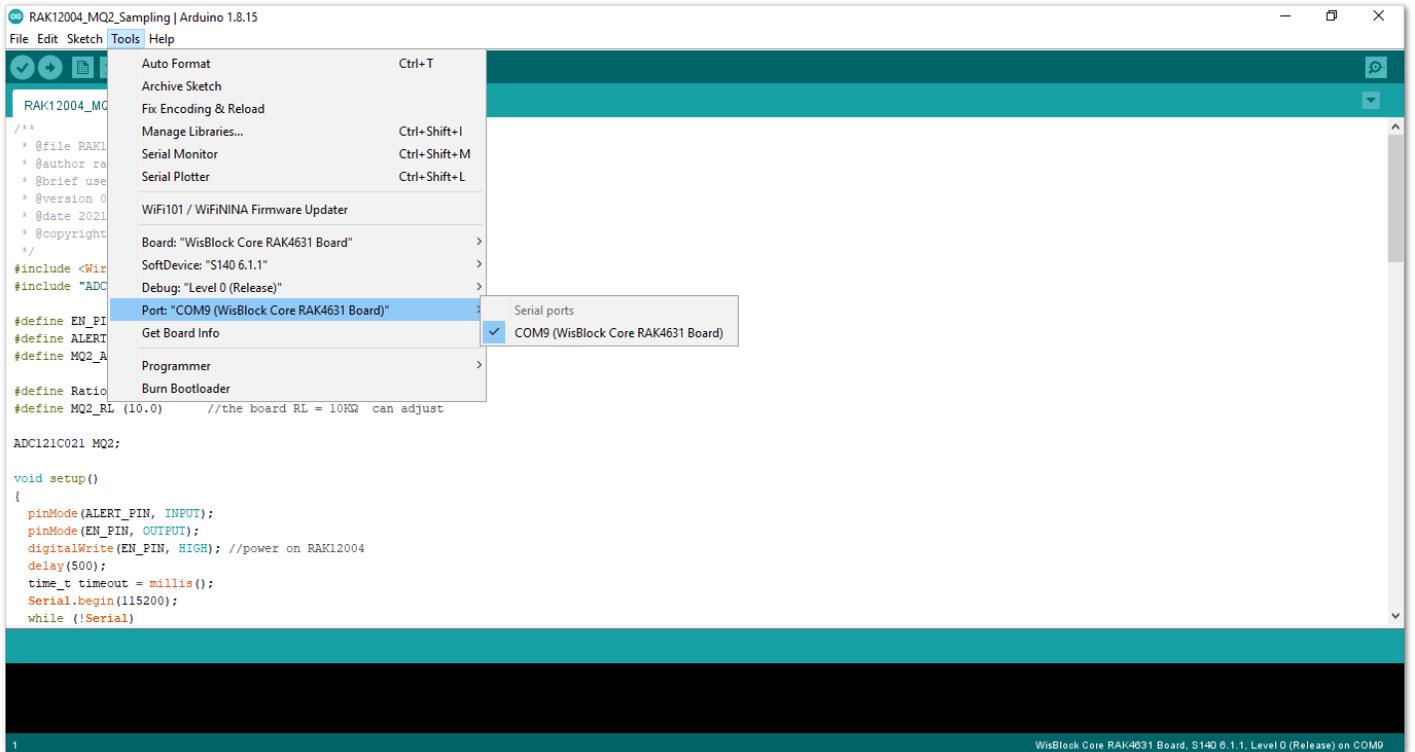


Figure 12: Selecting the correct Serial Port

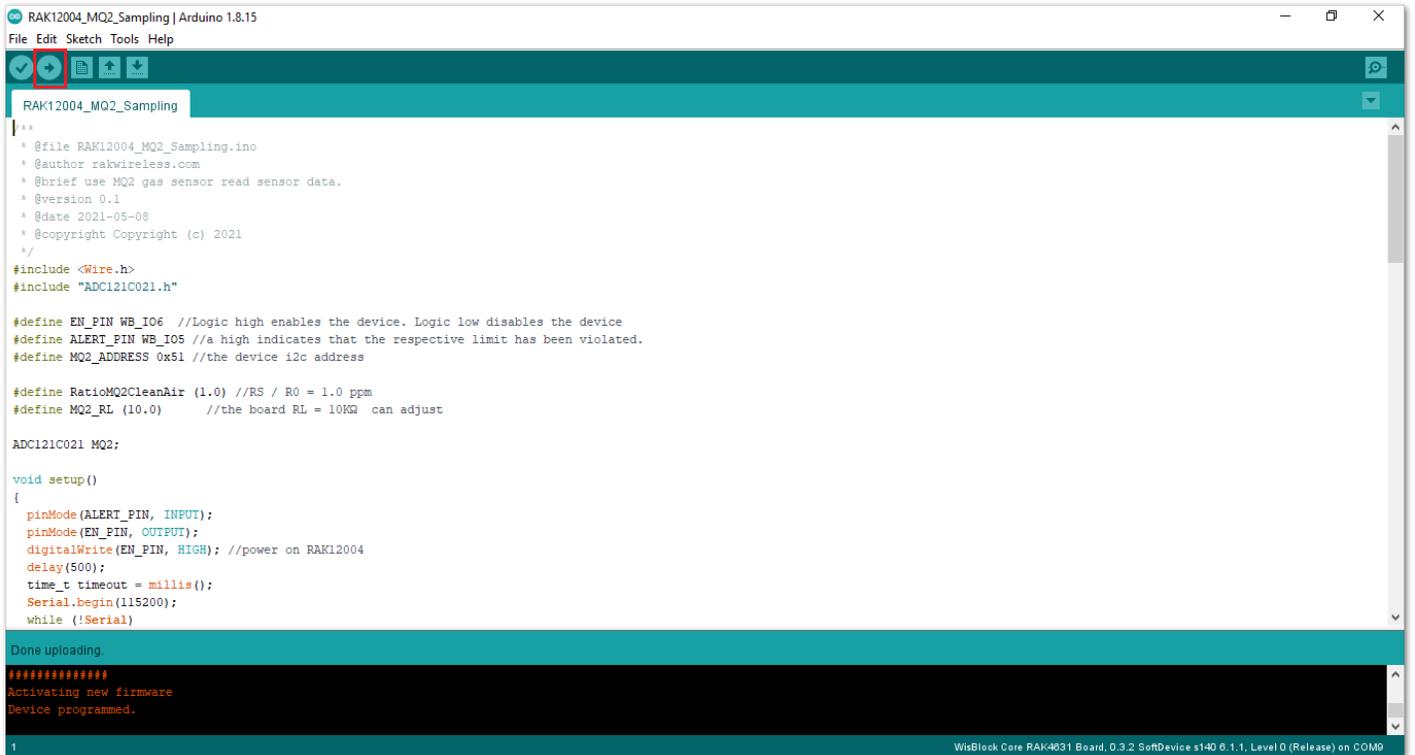


Figure 13: Uploading the RAK12004 example code on RAK4631

To extend the use of the RAK-MQx library, check the link [RAK-MQx Library methods](#)

Build RAK12004 Example on PlatformIO IDE (optional)

NOTE:

This procedure was tested only on Windows 10 and Ubuntu.

1. Install the original PlatformIO platform, as shown in [PlatformIO First Install](#) section.
 - For WisBlock Core RAK4631, install **Nordic nRF52** platform.
 - For WisBlock Core RAK11200, install **Espressif 32** platform.
 - For WisBlock Core RAK11310, install **Raspberry Pi RP2040** platform.
2. Open a project example that uses the new installed platform.

3. Launch **Visual Studio Code** and select **PlatformIO PIO Home**.
4. On **PIO Home**, click on **Project Examples**.
5. Choose **arduino-blink** project, then click on **Import** button.

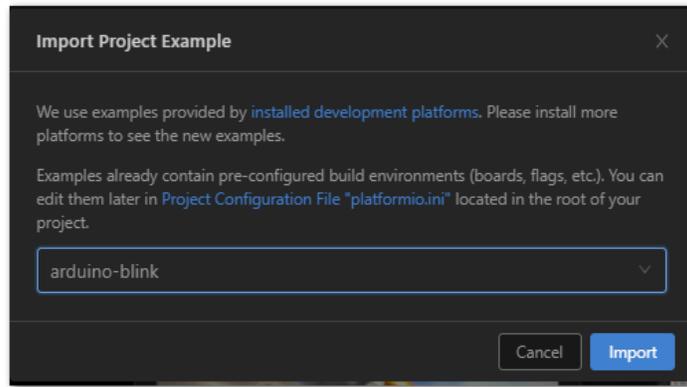


Figure 14: Import arduino-blink project

6. Click the **Yes** button on the trust window.

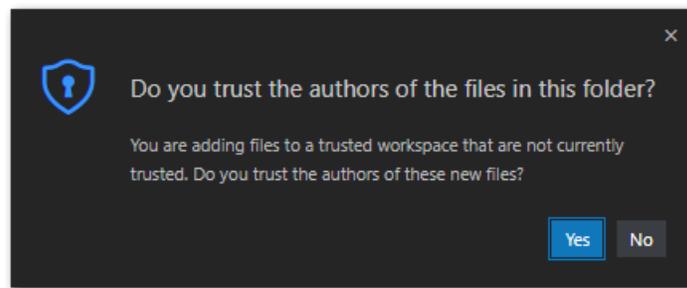


Figure 15: PlatformIO trust authors

7. Build the project and ignore warnings and errors.
8. Download and install the [RAK Patch script](#) .
9. Unzip the contents of RAK_PATCH.zip into the folder RAK_PATCH in your PlatformIO installation folder.

The table below shows the PlatformIO installation directory for each operating system:

PlatformIO path on different OS

Windows 10	<code>%UserProfile%\platformio\</code>
Linux	<code>~/.platformio/</code>
MacOS	<code>/Users/{Your_User_id}/.platformio/</code>

Figure 16 shows the PlatformIO installation directory on Windows 10.

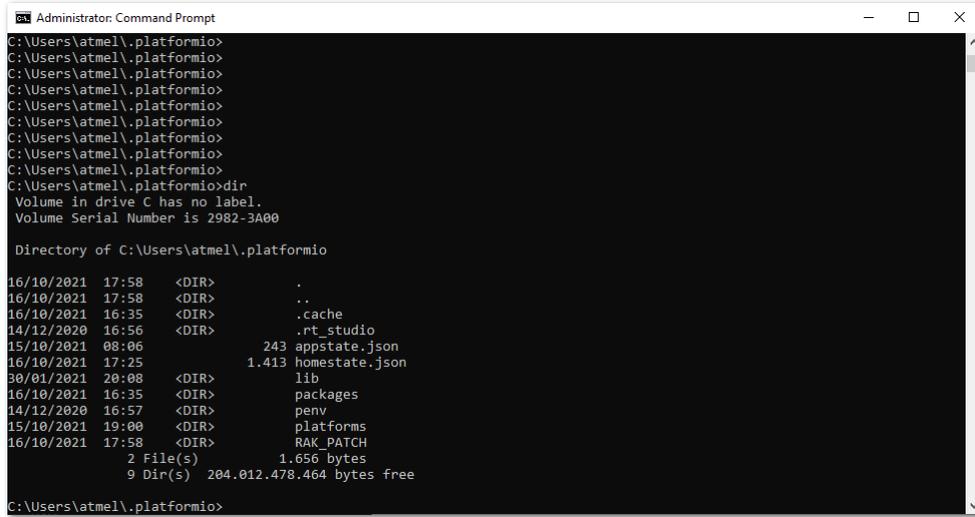


Figure 16: RAK patch folder on Windows

- Open a command prompt in `%UserProfile%\platformio\RAK_PATCH` folder and execute python `./rak_patch.py`.

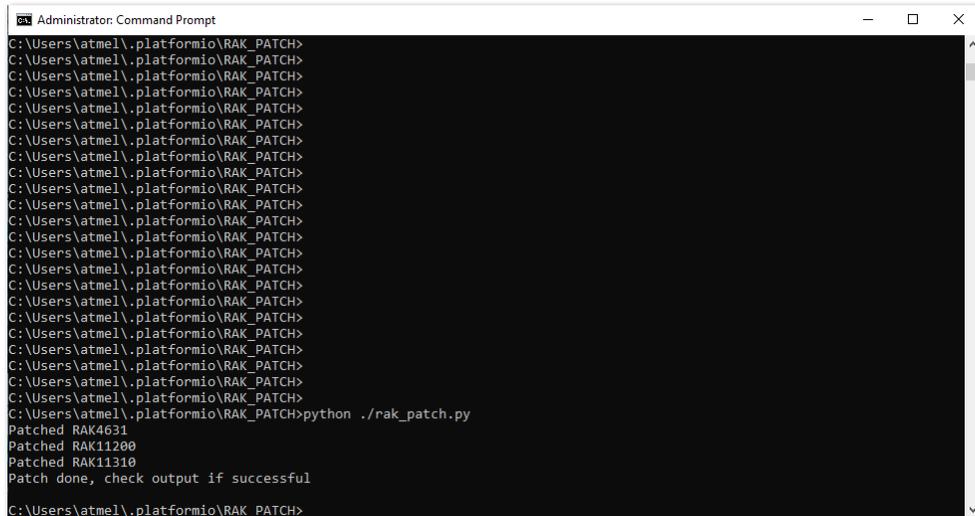


Figure 17: RAK patch installed on Windows

⚠ WARNING

In case of any platform update on PlatformIO, the **RAK_PATH** script must be executed again after the platform update.

- Import the RAK12004 Arduino Project to PlatformIO.
- Open **PlatformIO PIO Home** and select **Import Arduino Project**, as shown in **Figure 18**.

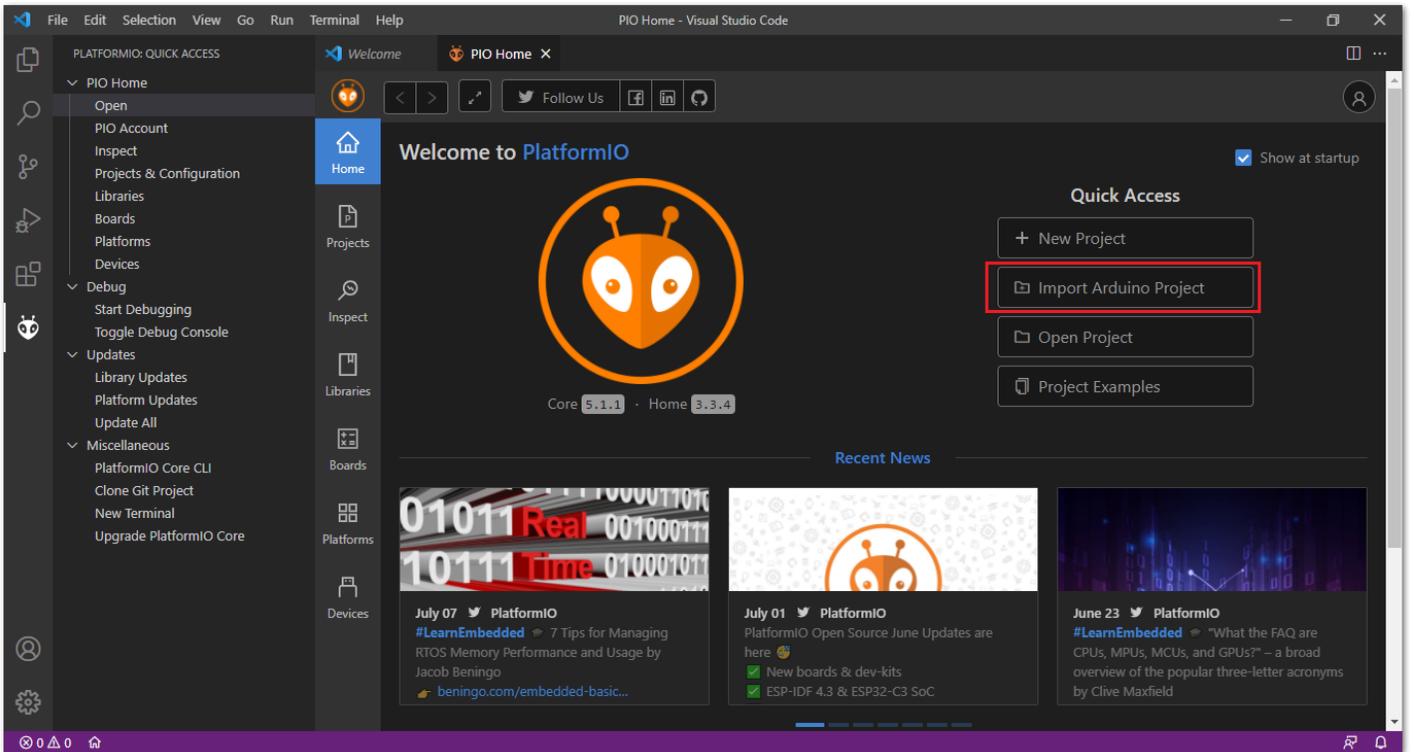


Figure 18: Import RAK12004 Arduino Project

13. Select your preferred **WisBlock Core** and check "Use Libraries installed by the Arduino IDE" option, as shown in Figure 19.

14. Then choose the directory of the original RAK12004 Arduino Project.

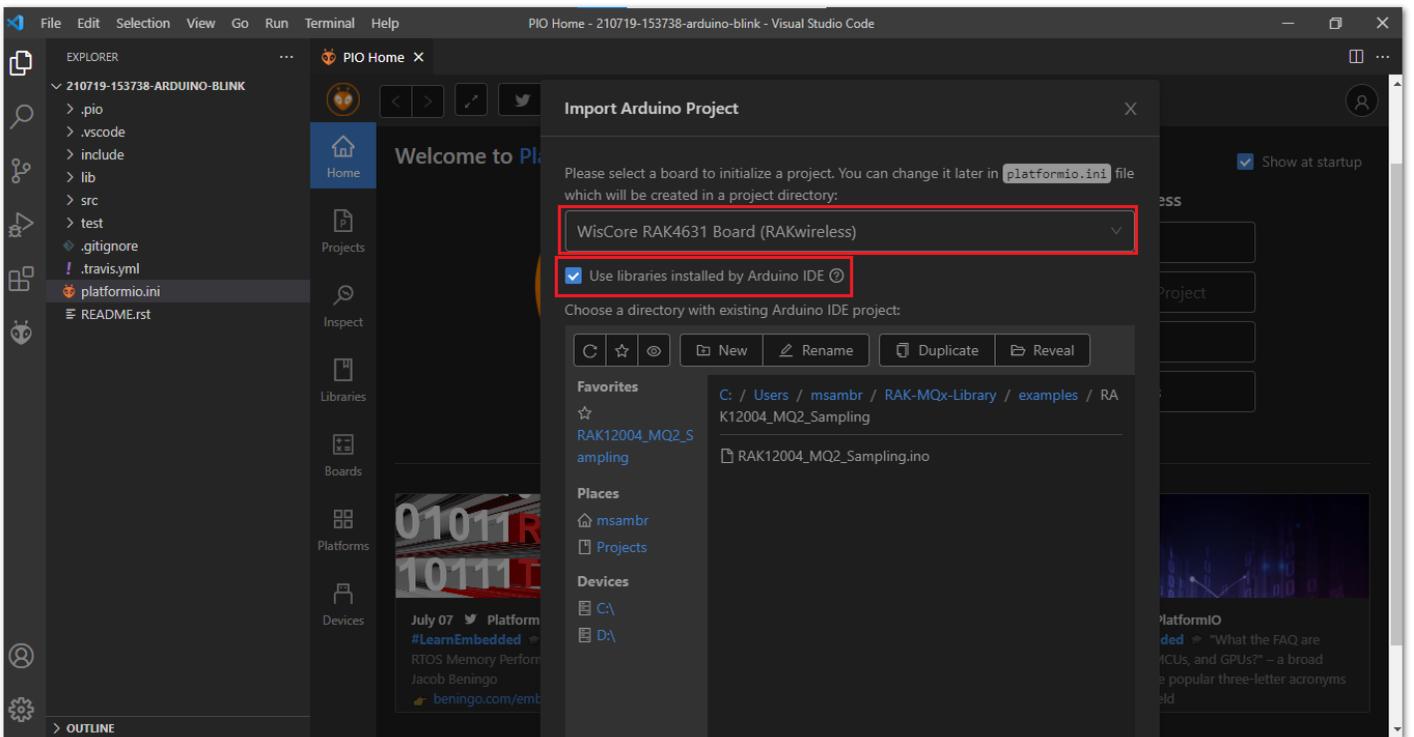


Figure 19: Select Board and check Import Libraries

15. To finish the import, click on the **Import** button, as shown in Figure 20.

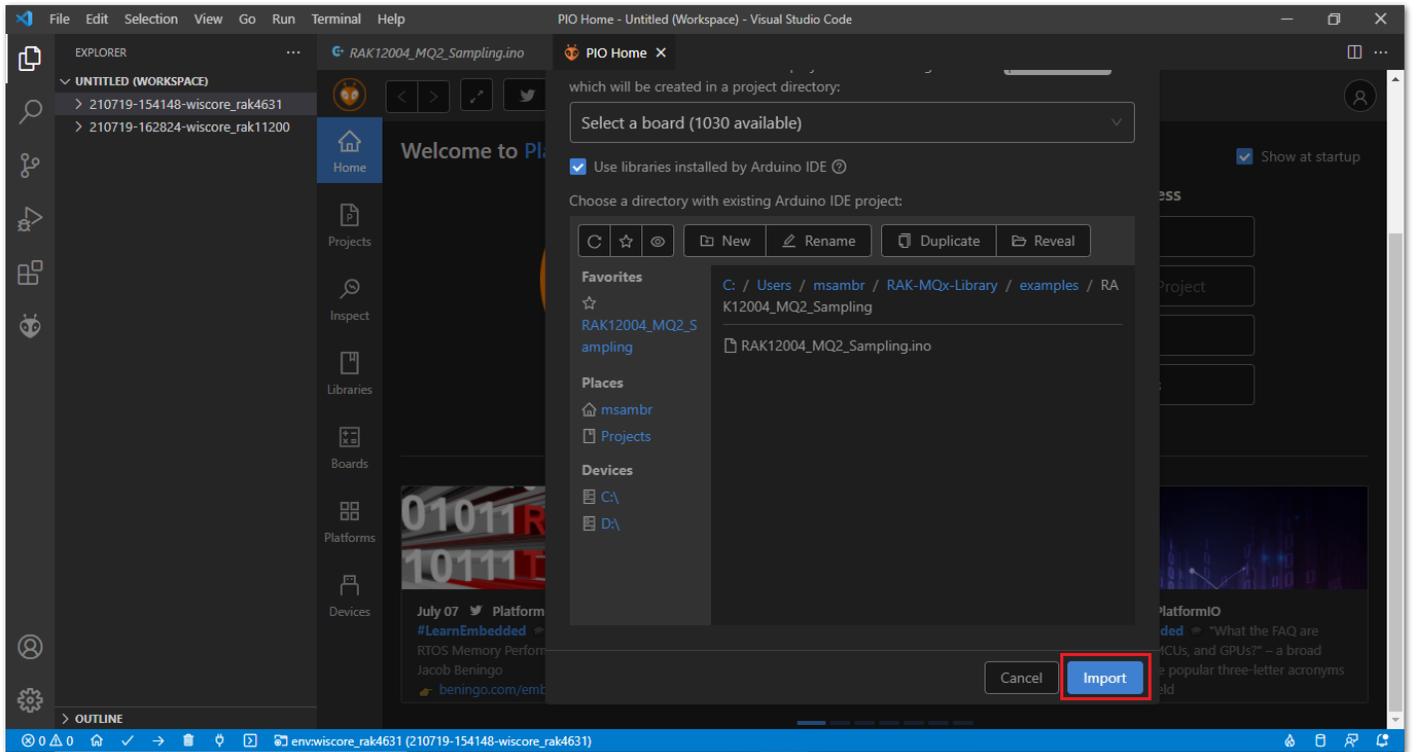


Figure 20: Select Board and check Import libraries

16. Build the imported project on the PlatformIO.

Now, you can build the project by clicking on the highlighted icon, as shown in Figure 21.

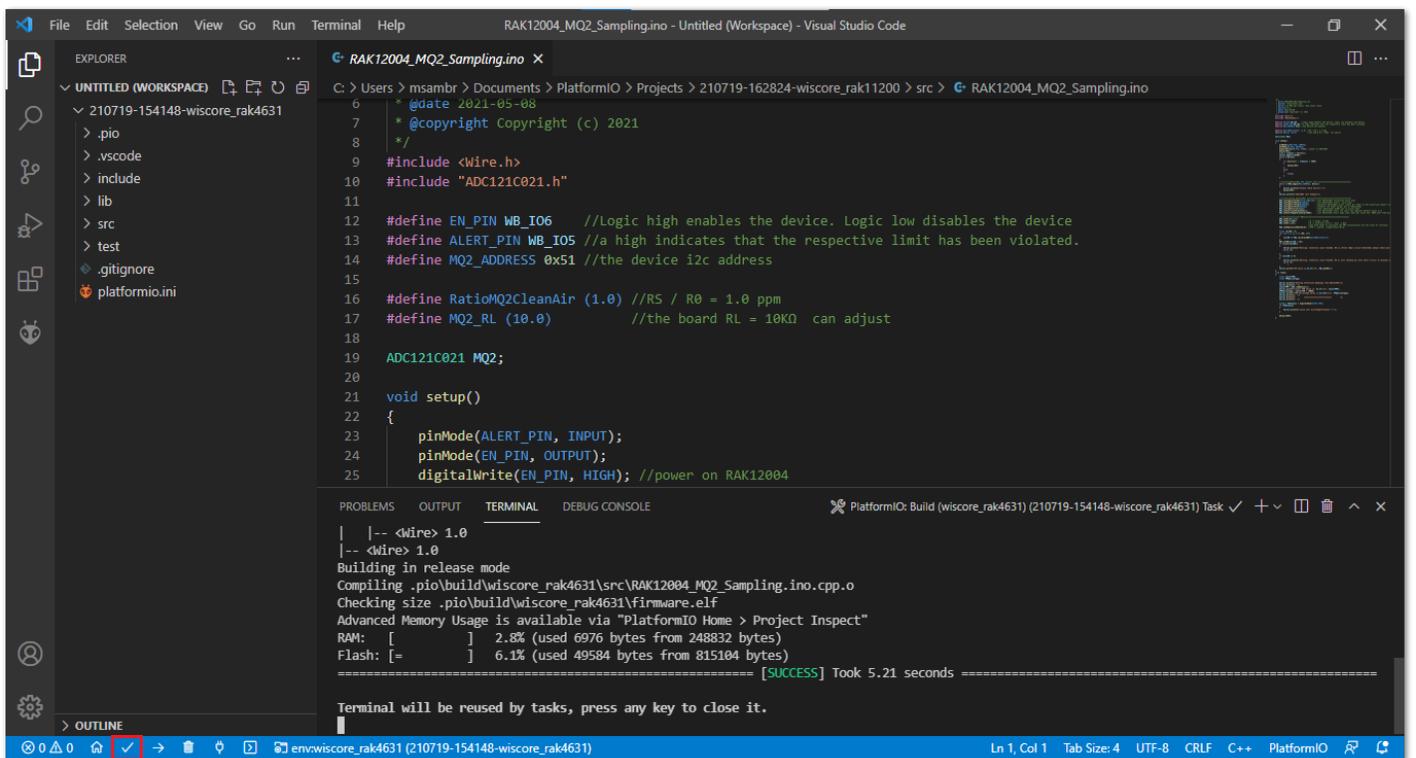


Figure 21: Build Arduino imported project

17. Upload the imported project on the PlatformIO.

18. To upload the project on the target board, click on the highlighted icon, as shown in Figure 22.

RAK12004 WisBlock MQ2 Gas Sensor Module Datasheet

Overview

Description

The RAK12004 is a gas sensor module, part of the RAKWireless WisBlock Sensor series. The sensor used is the MQ-2 from Zhengzhou Winsen Electronics.

Features

- MQ-2 gas sensor
- Sensitivity to LPG, butane, propane, methane, alcohol, hydrogen, smoke, and other flammable steam
- I2C Interface
- Alert function
- Detection Range: 300~10000 ppm (flammable gas)
- 3.3 V Power Supply
- Chipset: Winsen MQ-2
- **Module size:** 25 x 35 mm

Specifications

Overview

Mounting

The RAK12004 WisBlock MQ2 Gas Sensor Module can be mounted to the IO slot of the [WisBlock Base](#) board. **Figure 1** shows the mounting mechanism of the RAK12005 on a WisBlock Base module.

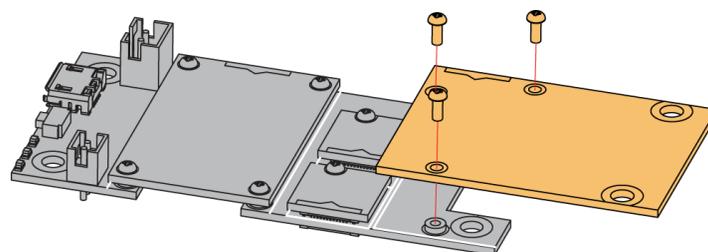


Figure 1: RAK12004 WisBlock MQ2 Gas Sensor Mounting

Hardware

The hardware specification is categorized into five (5) parts. It shows the chipset of the module and discusses the pinouts and their corresponding functions and diagrams. It also covers the electrical and mechanical characteristics that include the tabular data of the functionalities and standard values of the RAK12004 WisBlock MQ2 Gas Sensor Module.

Chipset

Vendor	Part number
Winsen	MQ-2

Pin Definition

The RAK12004 WisBlock MQ2 Gas Sensor Module comprises a standard 40-pin WisConnector. The WisConnector allows the RAK12004 module to be mounted to a WisBlock Base Board. The pin order of the connector and the pinout definition is shown in **Figure 2**.

NOTE:

I2C related pin, **ALERT**, **EN**, **VBAT**, **3V3**, and **GND** are connected to 40-pin WisConnector.

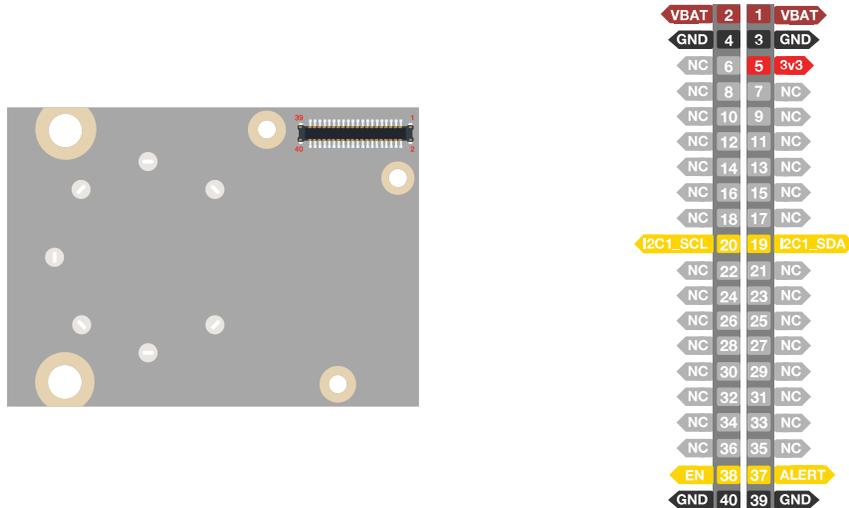


Figure 2: RAK12004 WisBlock MQ2 Gas Sensor Pinout

Electrical Characteristics

Recommended Operating Conditions

Symbol	Description	Min.	Nom.	Max.	Unit
VBAT	Supply Voltage	2.8	-	4.2	V
VCCIO	Digital IO Power Supply	-	3.3	-	V
VCC	ADC to I2C Chip Power Supply	-	5	-	V

Mechanical Characteristics

Board Dimensions

Figure 3 shows the dimensions and the mechanic drawing of the RAK12004 module.

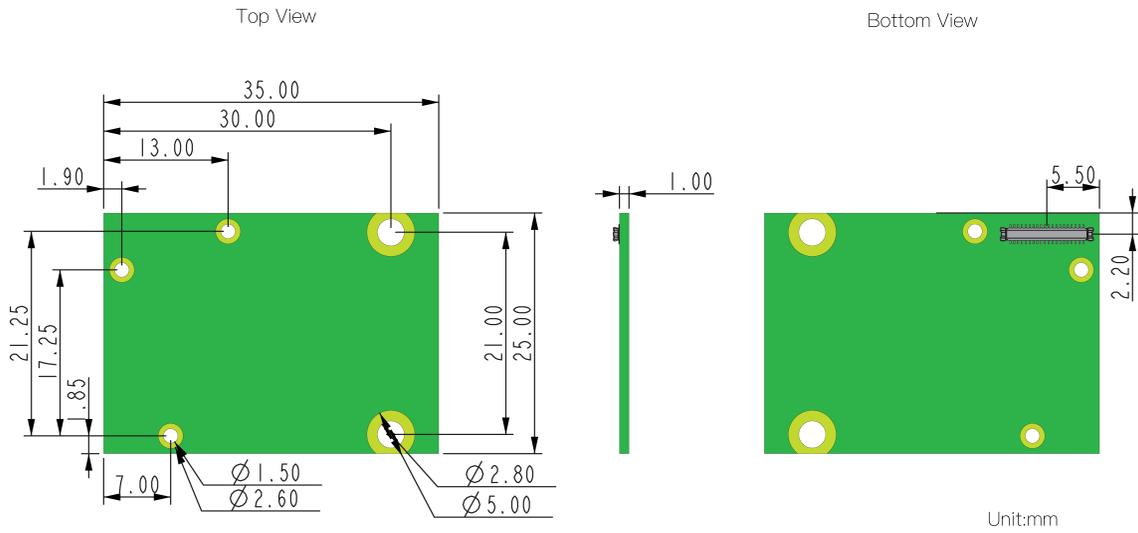


Figure 3: RAK12004 WisBlock MQ2 Gas Sensor Module Mechanic Drawing

WisConnector PCB Layout

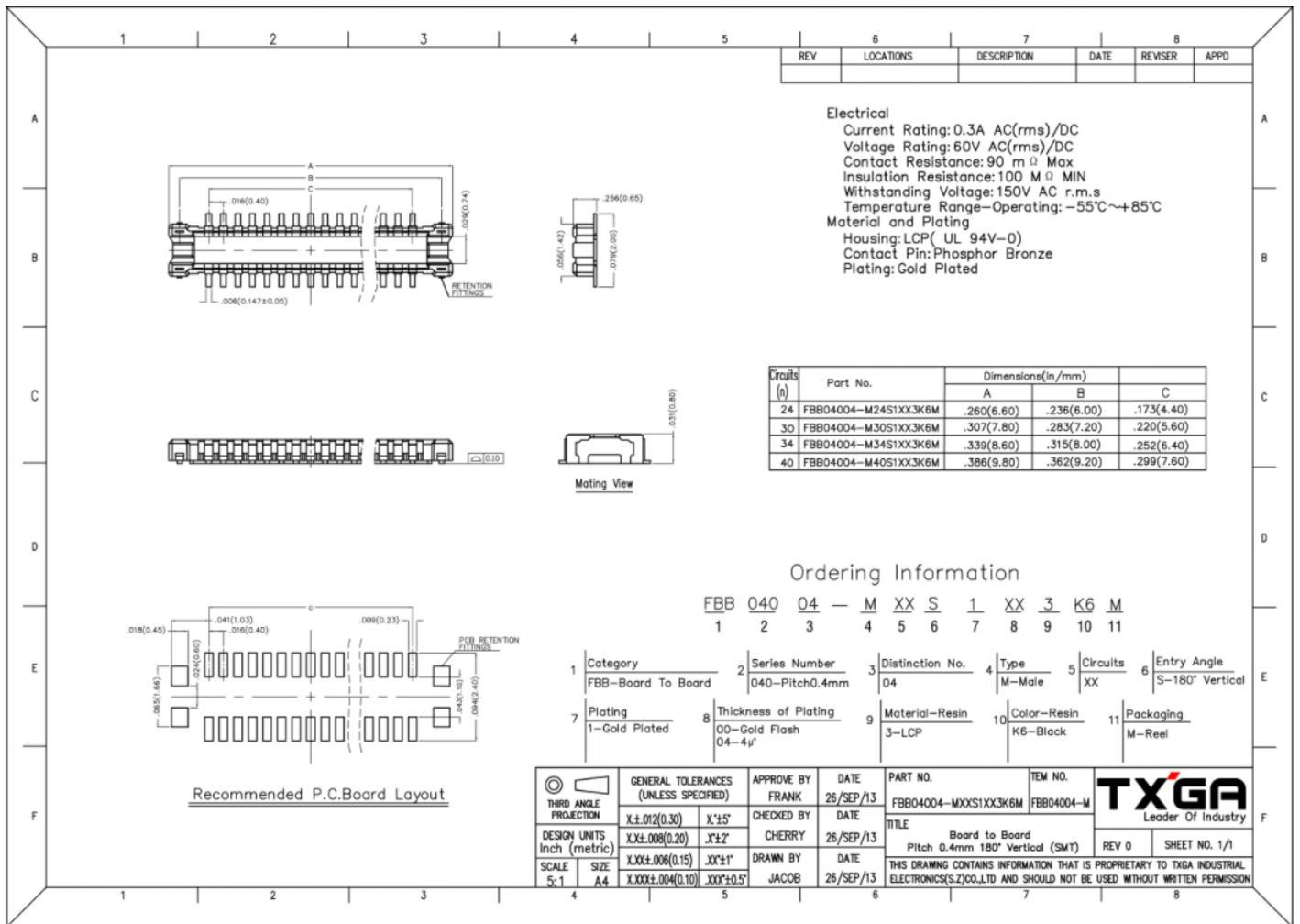


Figure 4: WisConnector PCB Footprint and Recommendations

Schematic Diagram

Power Supply Circuit

Figure 5 shows RAK12004 step-up power supply circuit.

- VBAT Battery voltage (max voltage is 4.2 V)
- EN Power enable pin (active high). This pin is connected to IO6 of WisBlock Core.

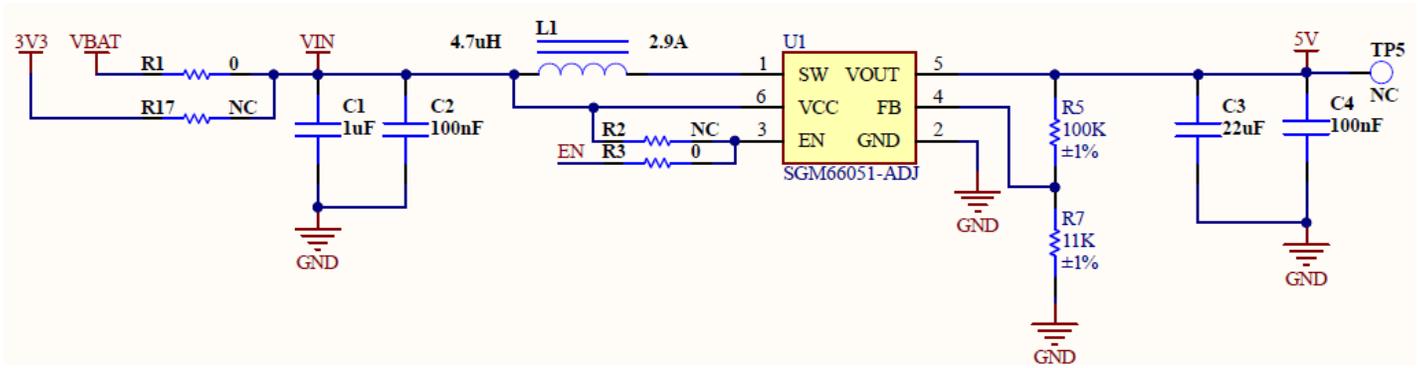


Figure 5: RAK12004 WisBlock MQ2 Gas Sensor Module Power Supply

Gas Detector Circuit

Figure 6 shows the gas detector circuit.

- **U2** Gas sensor

The heater voltage requires a 5 V supply which is provided by the 5 V step-up converter. This is needed to achieve the standard working temperature of the sensor. The pins 1 and 3 voltage (5 V) supply the detect voltage to load resistance R12. The **AOUT** pin is the voltage of load resistance R12 which represents the reading of the U2 sensor.

- **U3** ADC121C021 12-Bit Analog-to-Digital converter with alert function. The U3 power supply is 5 V.

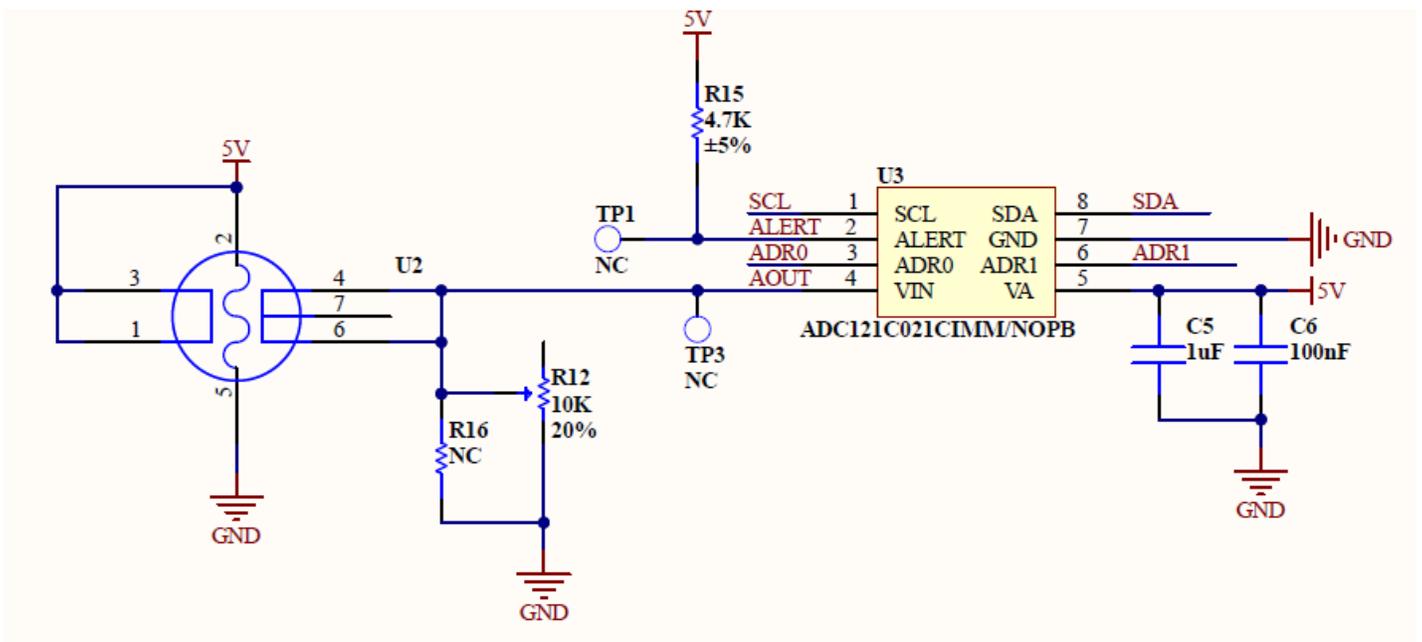


Figure 6: RAK12004 WisBlock MQ2 Gas Detector Circuit

Voltage Level Shifter Circuit

The 40-pin WisConnector voltage has a voltage level of 3.3 V while U2 and U3 have 5 V. To interface the different voltage level between 40-pin Wisconnector and gas sensor, the RAK12004 has a built-in voltage level shifter circuit.

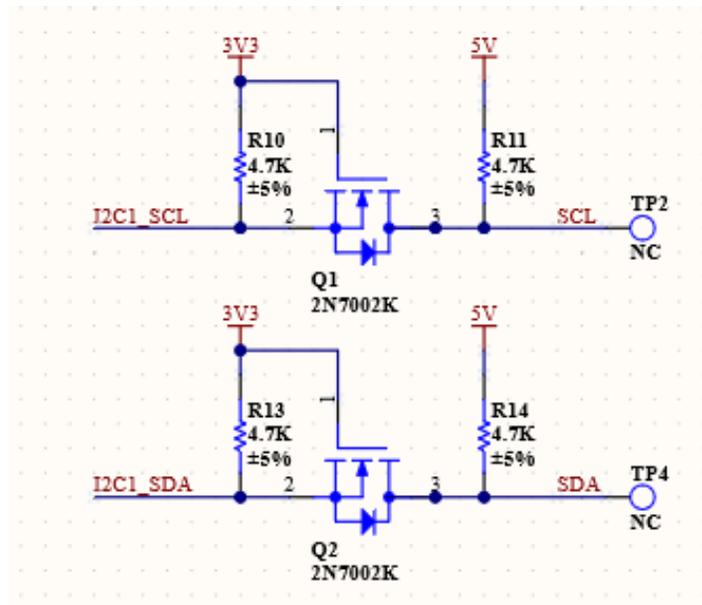


Figure 7: Voltage Level Shifter Circuit

I2C Address

The I2C address of the Analog-to-Digital converter chip of RAK12004 can be configured via resistor jumpers as shown in Figure 8.

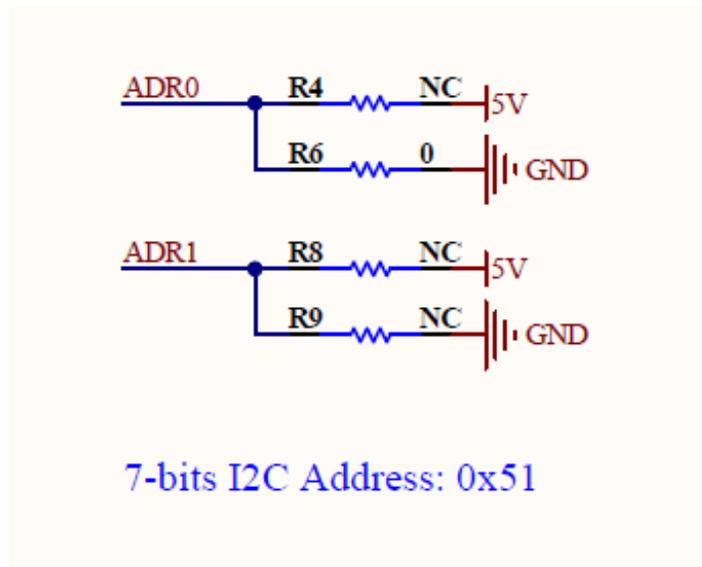


Figure 8: RAK12004 I2C Address

J2 Connector Pinout

RAK12004 has an additional connector to provide an extra interface to the module. The pinout of J2 connector is shown in Figure 9.

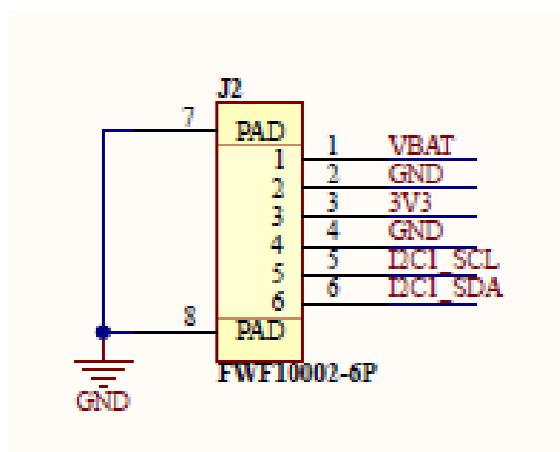


Figure 9: J2 Connector Pinout

Figure 10 shows 40-pin WisConnector pinout.

- **VBAT** battery voltage
- **I2C1_SDA** and **I2C1_SCL** are I2C related pins
- **EN** is power chip enable pin
- **ALERT** is analog-to-digital converter alert pin

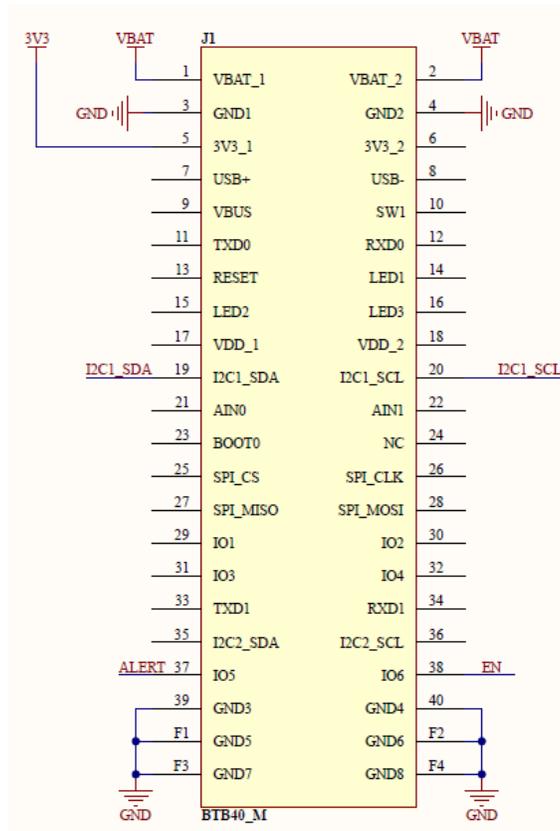


Figure 10: RAK12004 MQ2 Gas Sensor Module 40-pin WisConnector